

Aviation Safety Program



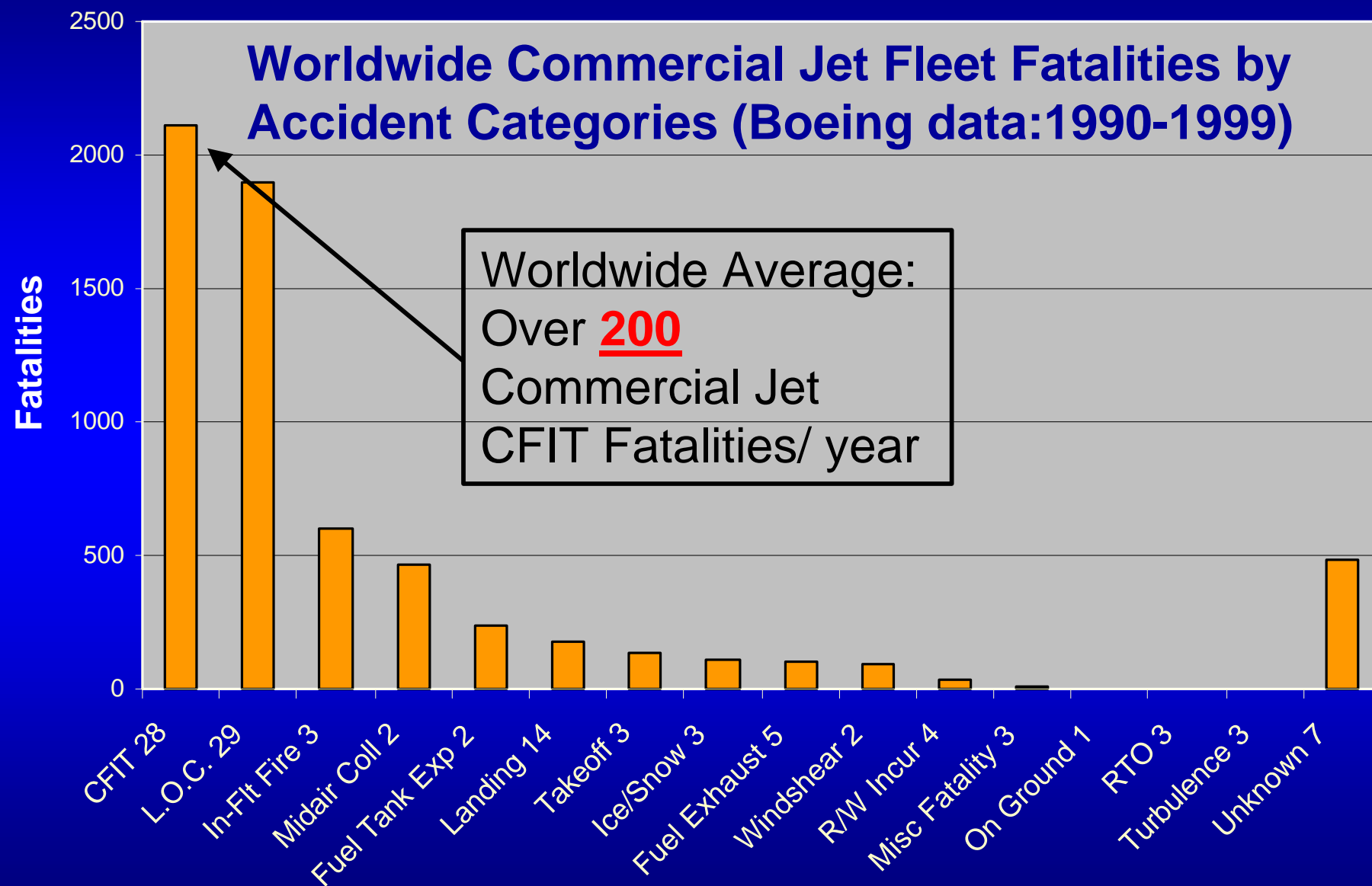
Dan Baize, Project Manager
SVS Technology Overview

October 24, 2000



Why Invest in Synthetic Vision Technologies

Aviation Safety Program: Synthetic Vision Systems



Categories & Number of Fatal Accidents



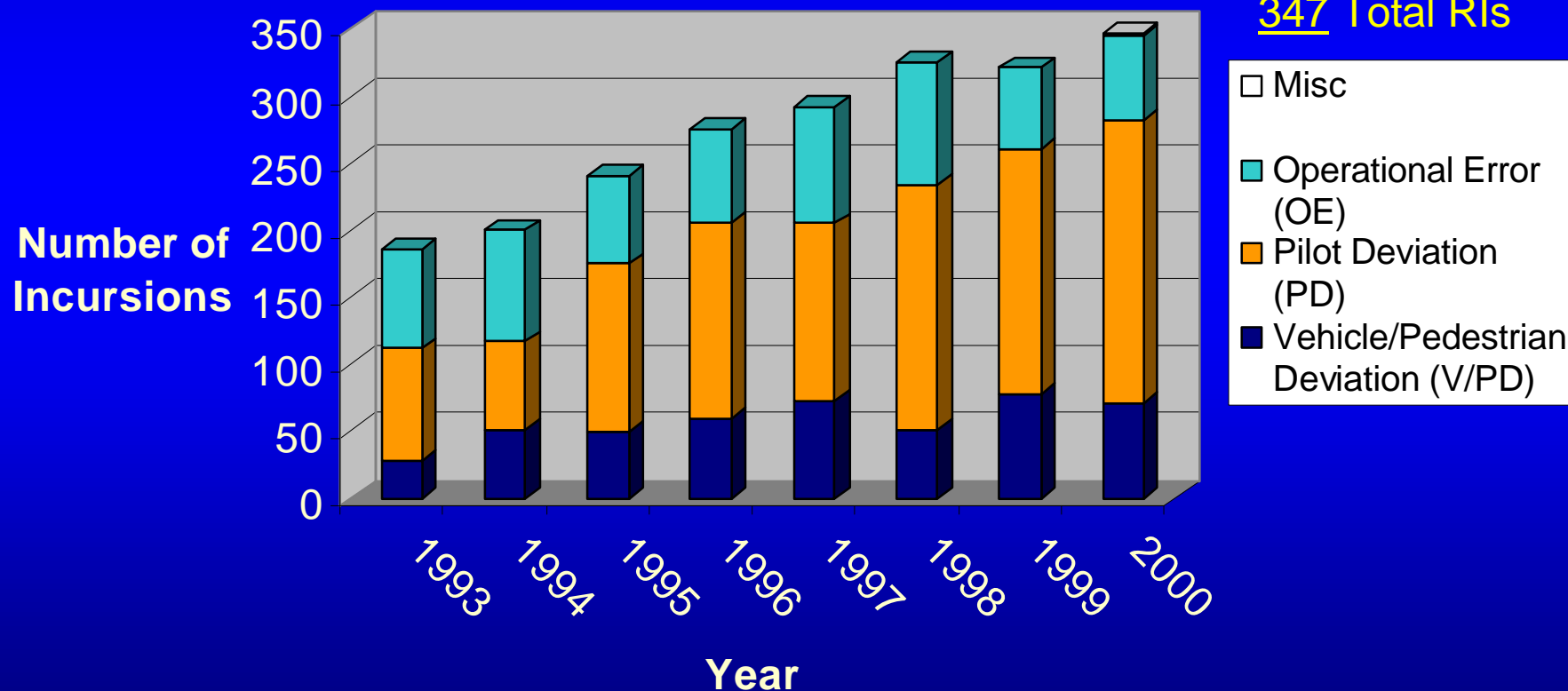
Runway Incursions: America's #1 Safety Issue

Aviation Safety Program: Synthetic Vision Systems

Runway Incursion: "Any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off or intending to take off, landing, or intending to land."

Runway Incursion Data (U.S.)

Data as of 10/20/00
347 Total RIs



Any **pilot** can cause a pilot deviation (PD) runway incursion - currently there are over 675,000 pilots.

Any **tower controller** can cause an operational error (OE) runway incursion - there are over 8,000 tower controllers.

Any **person** or **vehicle** on an airport can cause a vehicle/pedestrian deviation (V/DP) runway incursion.



World's Worst Aviation Accident: Runway Incursion

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Runway Incursion at Tenerife Kills 578



N736PA "Clipper Victor" (shown on left) unloading after arriving from JFK, was destroyed in a runway collision with KLM 747 PH-BUF (type example shown on right) at Tenerife.

3/27/77; KLM 747-200 & Pan Am 747-100; Tenerife, Canary Islands:

Because of **limited visibility** and **communications difficulties**

between air traffic control and the KLM aircraft, the KLM 747 started

its takeoff while the Pan Am aircraft was on the same runway. All 234 passengers and 14 crew were killed in the KLM 747. Nine of the 16

4 crew and 321 of the 380 passengers on the Pan Am flight were killed.



Synthetic Vision: A Technology Solution

Aviation Safety Program: Synthetic Vision Systems

Synthetic Vision Systems Goal: Eliminate Low-Visibility Induced Incidents and Accidents:

- **Controlled Flight Into Terrain (CFIT)**
- **Runway Incursions**
- **Landing Errors**



Through the introduction of advanced airborne technologies which increase situation awareness:

- **Vertical and Lateral Spatial Awareness** (know where you are)
- **Approved & Escape Path Awareness** (know where you need to go)
- **Terrain, Obstacle, Cooperative and Uncooperative Traffic, Weather Hazard Awareness** (know where the threats are)



Synthetic Vision System Definition

Aviation Safety Program: Synthetic Vision Systems

Synthetic Vision System: A database derived system which utilizes precise GPS navigation and integrity-monitoring sensors to provide a unrestricted synthetic view of the aircraft's current external environment.

SVS Characteristics:

- Provides intuitive perspective view
 - Conformality (FOV) may be selectable
- Sufficient for tactical guidance of aircraft
 - Must meet flight-critical system requirements
 - Containing all PFD or HUD functionality (transport category)
- Driven by Internal database & GPS position
 - Aerodrome, terrain & obstacle database requirements vary between vehicle classes
- Integrated integrity-monitoring sensors as required
 - Must detect/display both cooperative & uncooperative traffic around the runway environment
 - Sensor augmentation requirements vary between vehicle classes

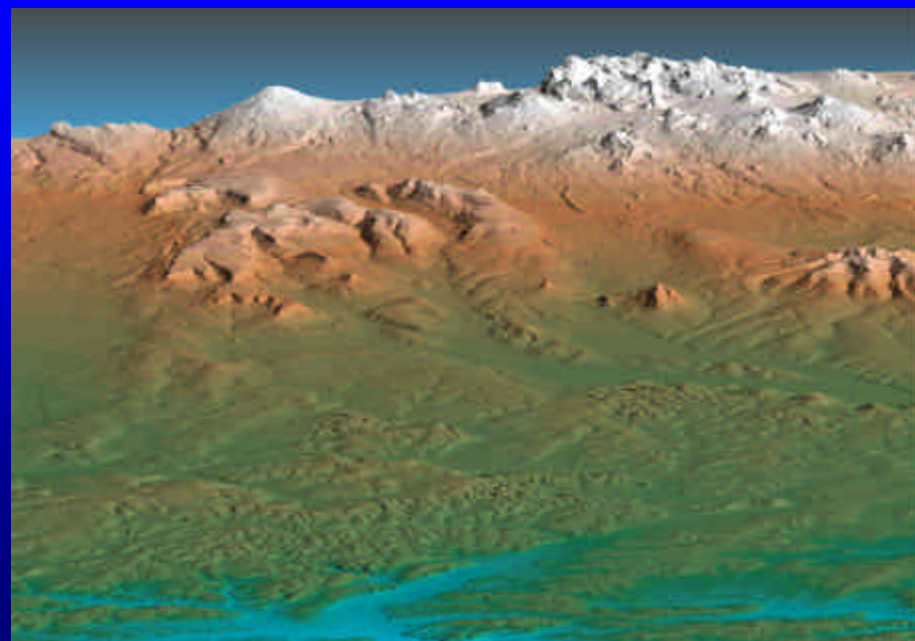
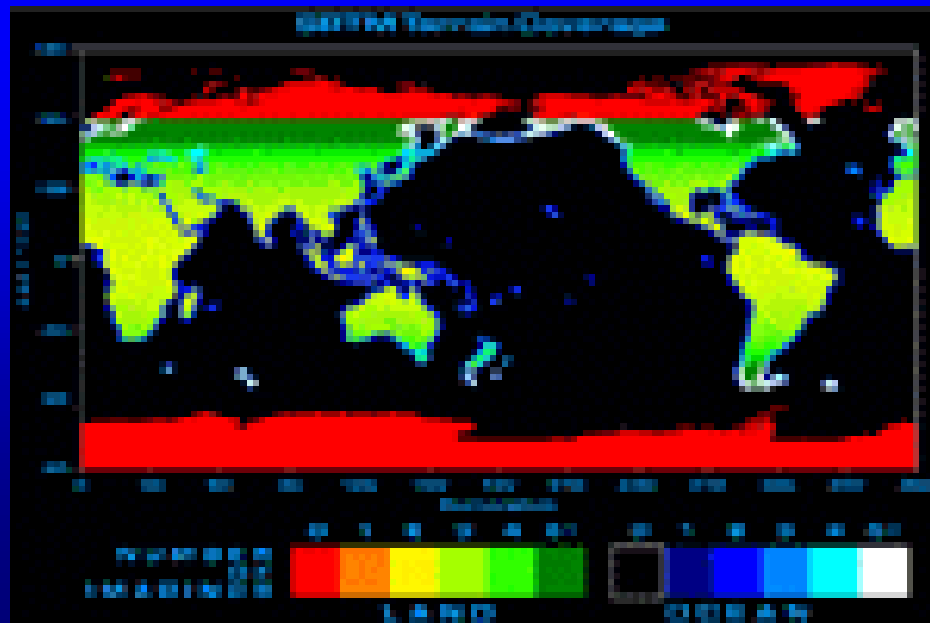
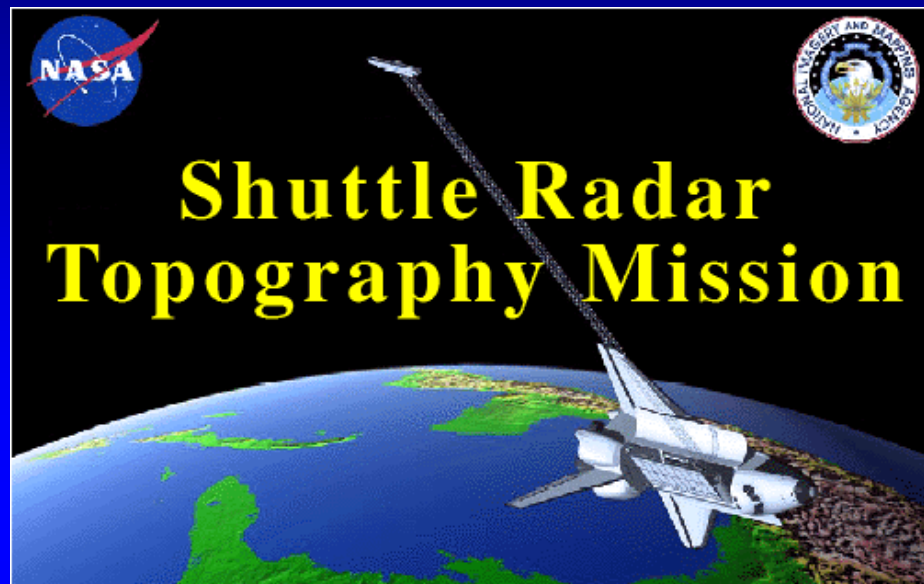




STS-99: Shuttle Radar Topography Mission

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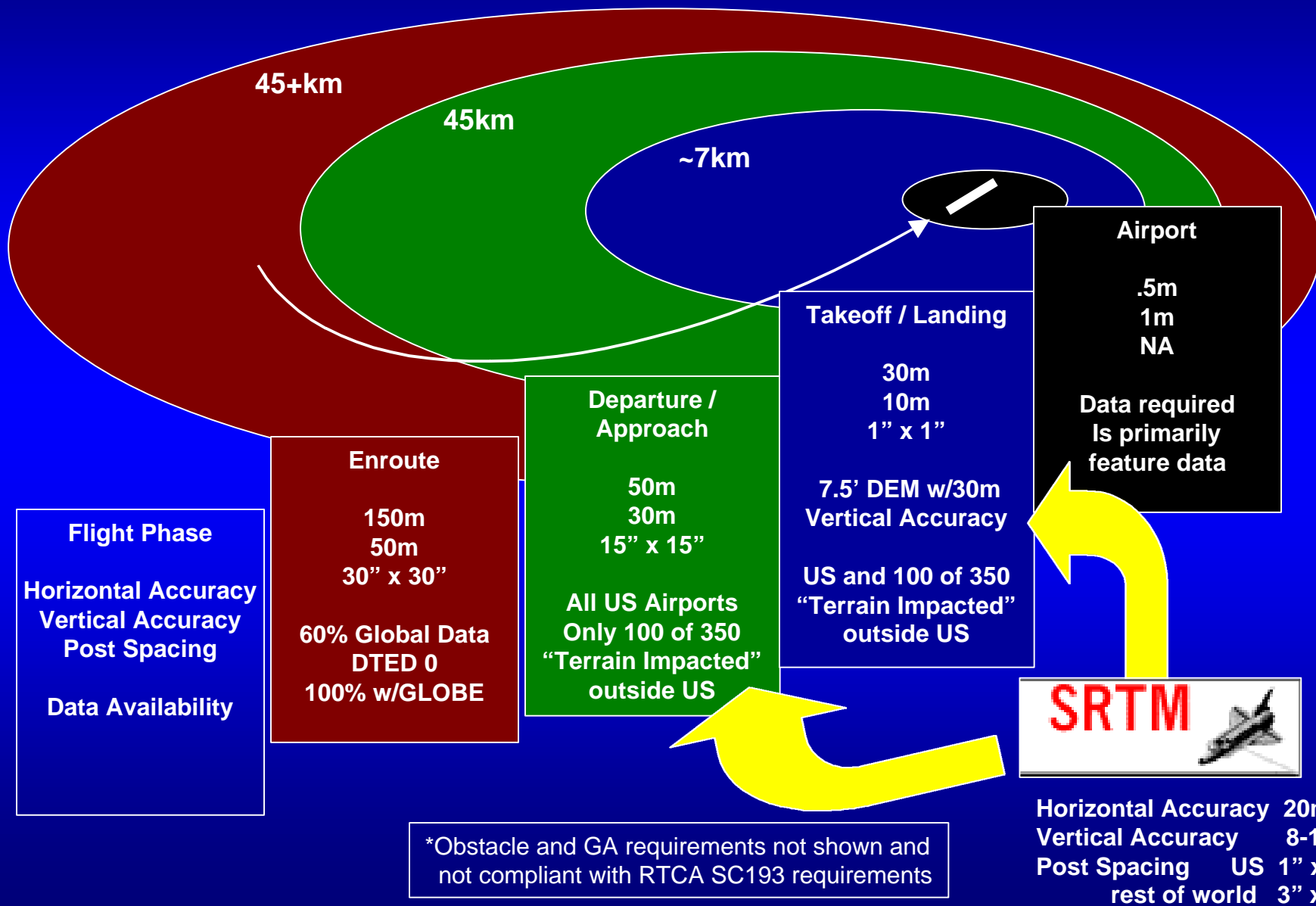
- STS-99 launched 2/11/2000: 10-day mission; 24 month data processing
- 80% of the Earth's land surface (99.96% of land between 60° N. & 56° S. latitude) mapped sufficiently for SVS enroute requirements
- \$700 Million investment by NASA/NIMA





Example SVS Nested Database Requirements

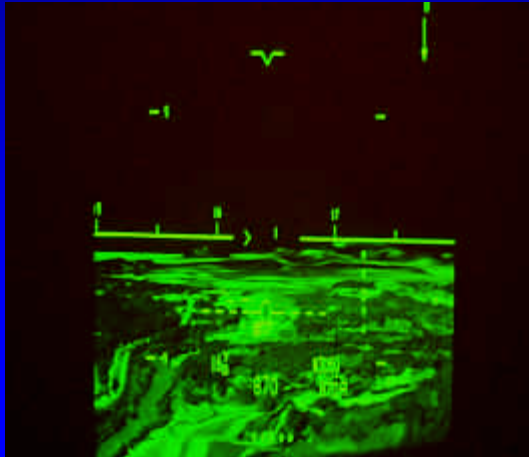
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Synthetic Vision System Components

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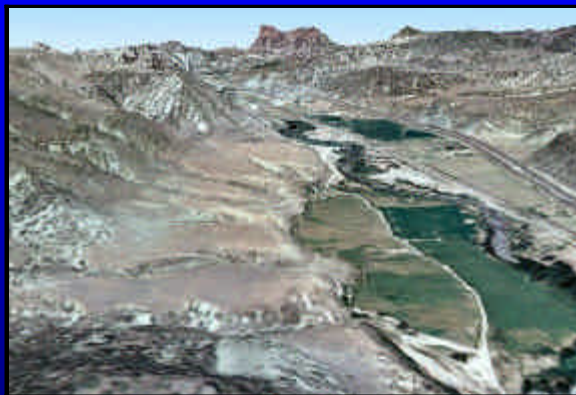
Enhanced Vision & Integrity
Monitoring Sensors



Synthetic Vision Display
Concepts & Adv. Guidance



Runway Incursion Prevention
System with EMM



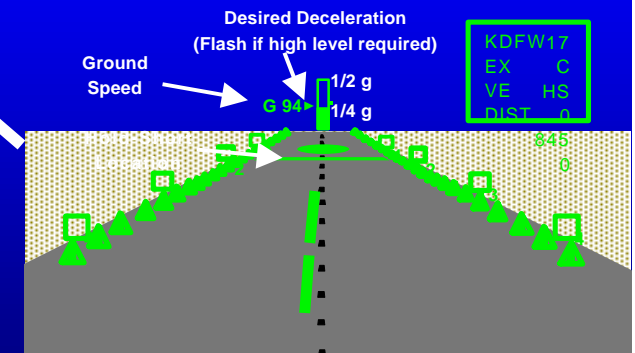
Worldwide Terrain, Obstacle
& Aerodrome Databases



Wx

ADS-B

GPS-LAAS/
WAAS



Hold Short Advisory
Landing Technology



Example Synthetic Vision Equipped Flight Deck

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SVS Cooperative Agreement Partnerships

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Commercial & Business Aircraft SVS:

Synthetic Vision Information Systems Implementation Team

- Team led by **Rockwell Collins**, Inc., Cedar Rapids, IA.
 - Members: Jeppesen-Sanderson, Inc., The Boeing Company, American Airlines, Delft University of Technology, Embry-Riddle Aeronautics University, and Flight Dynamics, Inc.



Future Flight Deck Information Management & Display System

- Team led by **BAE Systems**, Inc. CNI Division, Wayne, NJ.
 - Members: Canadian Marconi Company and Marconi Astronics

General Aviation SVS:

An Affordable, Certifiable Low End Thrust Synthetic Vision System

- Team led by **AvroTec**, Inc., Portland, OR.
 - Members: BF Goodrich, Elite Software, Lancair/PAC USA, Massachusetts Institute of Technology, Raytheon Aircraft, Seagull Technologies, Inc., and FAA-Civil Aeromedical Institute.

A Low cost Synthetic vision Display System Capability for General Aviation

- Team led by **Research Triangle Institute**, Research Triangle Park, NC.
 - Members: Archangel Systems, Inc., Flight International Inc., Seagull Technologies, Inc., Dubbs & Serverino, Inc., and FLIR Systems, Inc.



SVS Cooperative Agreement Partnerships, cont.

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General Aviation SVS, cont:

Low-cost Attitude and Heading Reference System (AHRS) to Enable Synthetic Vision

- Team led by **Seagull Technology Inc.**, Los Gatos, CA
 - Members: Dynamatt, BARTA, S-Tec Unmanned Technologies, Inc., Reichel Technology; Rockwell Collins, Inc., Cedar Rapids, Iowa; Stanford University, Stanford, California; Raytheon Aircraft, Wichita, KS

Enabling Technologies for SVS:

Worldwide Terrain Database

- **Boeing - Jeppesen-Sanderson** Inc., Englewood, CO

A DTED Terrain Avoidance System Utilizing GPS and Radar Altimeter Monitoring

- Avionics Engineering Center of **Ohio University**, Athens, OH.

Runway Incursion Advisory and Alerting System

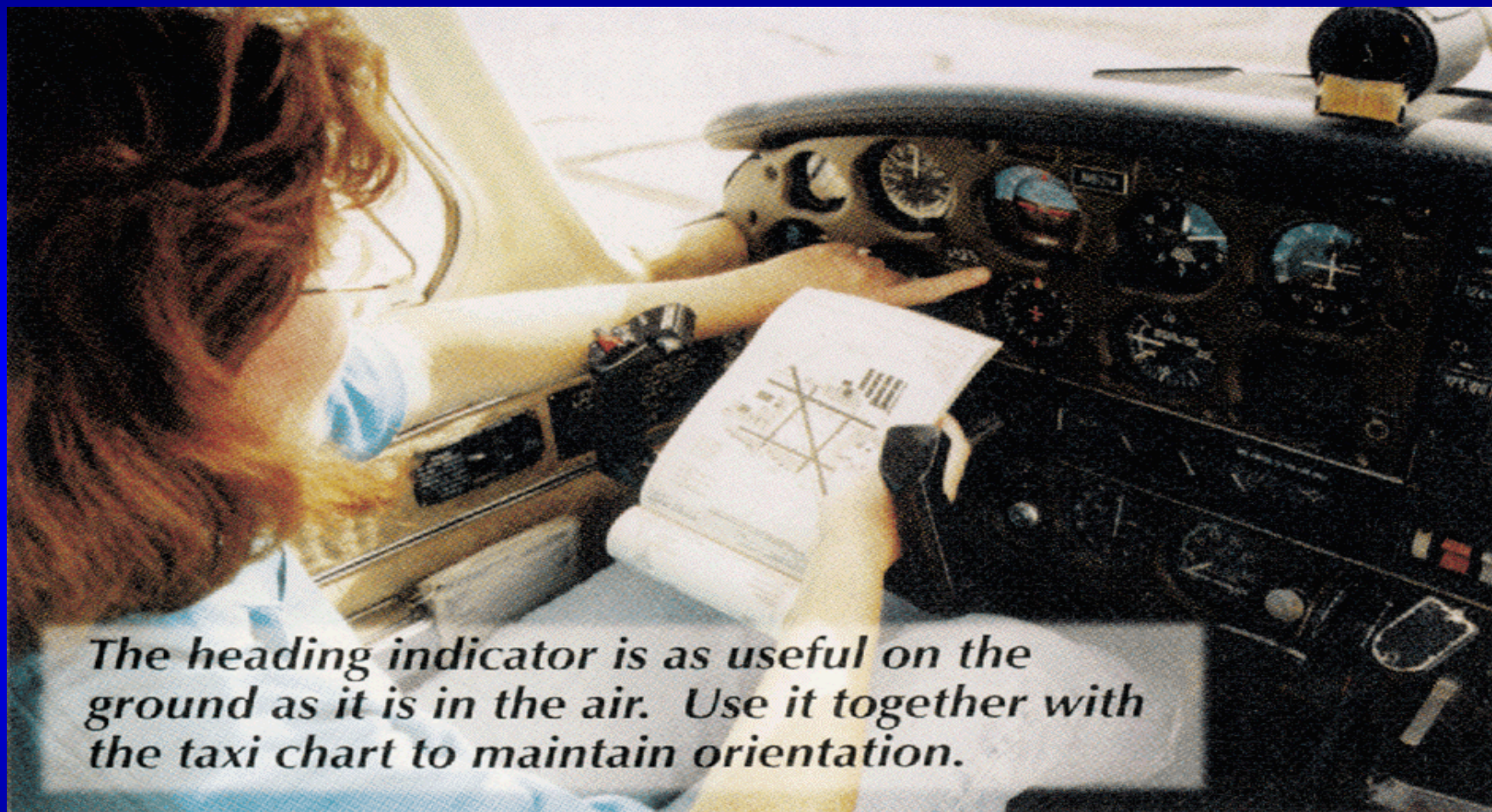
- **Rannoch Corp.**, Alexandria, VA.



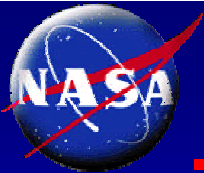


Summary: We Can do Better than This

Aviation Safety Program: Synthetic Vision Systems



RIPS/SVS technologies are maturing rapidly



Remaining Presentations

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Synthetic Vision Display Concepts

NASA

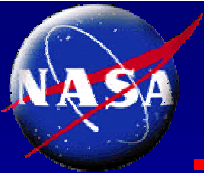
Rockwell Collins

Runway Incursion Prevention System

Hold Short Advisory Landing Technology

Surface Guidance System

Flight Demo Logistics



Next Presentation

Aviation Safety Program: Synthetic Vision Systems

Synthetic Vision Display Concepts

NASA

Dan Williams- SVS Concept of Operations Lead

Ask Questions at any Time; Enjoy your Flight